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CONLEY ROSE, P.C.
P. O. BOX 3267
HOUSTON, TX 77253-3267

EXAMINER	
WERNER, BRIAN P	
ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/032,272	SONG ET AL.	
	Examiner	Art Unit	
	Brian P. Werner	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 July 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9 and 13-45* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9 and 13-45* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The arguments received on July 11, 2005 have been entered and considered herein below. Claims 1-9 and 13-45 remain pending.

2. Claims 15, 17, 18, 21 and 31 - Anticipated by Ortiz et al. by (US 4,988,875 A)

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 15, 17, 18, 21 and 31 are rejected under 35 U.S.C. 102(b) as being anticipated by Ortiz et al. by (US 4,988,875 A).

Regarding claim 15, which is representative of claim 31, Ortiz discloses:

plural imaging devices (figure 11, numerals 36; "120 degrees from each other, can provide view of the entire bulk of the cable jacket" a column 6, line 58) each recording a video signal ("video camera" at column 4, line 33) of coiled tubing as the tubing passes in front of the imaging devices (figure 1, numeral 20; figure 11, numeral 105 designating the same; the inspection system examines a "jacket" that is coiled as depicted in figure 1, and the "jacket" is a

tubing because it is hollow on the inside; the claim does not preclude the tubing from being filled, such as with a copper wire in the Ortiz reference); and

a computer performing pattern recognition an analyzing each the images from the video signals separately extracting discrete anomalies (figure 11, numeral 112; also see figure 12; each image of the "video signal" at column 7, line 3, is analyzed for the presence of a defect; "determine whether or not there are any defects in the cable jacket as the cable passes" at column 6, line 62; "whenever a defect occurs in the natural polyethylene, the magnitude of the video signal changes" at column 7, line 5; and the "motion detector circuits 112 detect these variations" at column 7, line 7; looking at figure 11, there are as many motion detector circuits as there are cameras, with each detector responding to its associated camera signal; therefore, each camera image is analyzed separately) and generating an indication if an anomaly is a defect (e.g., "time delayed signal representing the occurrence of any defect" at column 7, line 13; "location of the cable area being documented" at column 7, line 40). Regarding the "analysis" or "analyzing" limitation, each motion detector accepts the video signal of its corresponding camera as input. Without some sort of analysis, noting would be achieved. The Ortiz motion detectors take the video signals and analyze each of them, separately, for the presence of a magnitude change as depicted in figure 12.

Regarding claim 17, the cameras are CCDs ("CCD" at column 4, line 25).

Regarding claims 18 and 21, a video stacker correlates images (figure 11, numerals 124 and 126; "combines signals from up to four video cameras sources into four video signal

windows at its output" at column 7, line 31) with a longitudinal position using a counter signal (figure 11, numeral 116; "location of the cable area being documented" at column 7, line 40).

(B) Response to Arguments:

Applicant's Remark: "Ortiz et al. does not teach analyzing each image separately but instead teaches detecting the change in video signal magnitude between at least two images" at page 10, section II.B.

Examiner's Response: To preface the response, it must be understood that Ortiz indeed discloses the use of a "video camera" ("video camera 36" at column 6, line 59), and "video" cameras output a sequence of images of a scene (e.g., "clear image" at column 5, line 23). Referring to the video cameras and motion detectors of Ortiz at figure 11, numerals 36 and 112, each video camera 36 outputs a signal corresponding to a time series of scans within an image. Ortiz states that "each defect that shows in a screened image will cause a variation in the signals delivered from the relevant camera 36 to the associated motion detector circuit 112" at column 6, line 64. Such a variation is depicted in Ortiz figure 12. Video cameras "scan" an image. That is, a single image is comprised of a number of relatively horizontal scans from the top to the bottom of an image. While the nature and direction of the scanning of the Ortiz camera is irrelevant, the fact remains that each image (being "video") is comprised of a number of scans, and the signal corresponding thereto. Ortiz states, "while the video cameras are scanning ..." at column 7, line 1, "whenever a defect occurs ... the magnitude of the video signal changes, as

show by the peaks 82" at column 7, line 5. Thus, given that a peak is detected within a scan signal, and a scan occurs within a frame (video signals are blanked between frames), then the peak must occur within a frame. Thus, a defect corresponding to a detected peak is detected within a frame.

Now, referring specifically to applicant's argument that "Ortiz et al. does not teach analyzing each image separately", Ortiz necessarily analyzes each image separately given that scan signals are analyzed to detect peaks, and scan signals occur within frames. When the frame ends, the signal is temporarily blanked and then a new frame (image) begins, and the analysis of the scans within that frame begin anew. Stated another way, Ortiz analyzes scans in a time series, and in a video signal, one frame is scanned at a time. Therefore, any analysis of a particular scan signal to detect peaks naturally occurs within a particular frame – scans don't occur between frames or across frames. When the new frame begins, the analysis starts anew. The scan signals associated with particular frames (images) are analyzed separately, one at a time, in time series because the next frame does not begin until the current frame ends. The frames produces be each video camera 36 of Ortiz are NOT analyzed together, or in parallel.. **Ortiz states that "each defect that shows in a screened image will cause a variation in the signals delivered from the relevant camera 36 to the associated motion detector circuit 112" at column 6, line 64.** Here, Ortiz teaches that "signals" within an "image" (i.e., "screened image") will show the "variations" associated with defects. Ortiz meets the claimed requirements.

Referring specifically to the applicant's argument that Ortiz "instead teaches detecting the change in video signal magnitude between at least two images", this is unfounded by the

Ortiz reference. Ortiz does not compare two separate frames, or images. If Ortiz does teach this, the examiner cannot find it within the reference and the applicant has not pointed to where this is taught by Ortiz. Again, Ortiz analyzes scan signals in a time series as they arrive from the video camera, and video cameras output a series of scans within a frame. When the frame ends, a new frame begins and the analysis begins over again. Ortiz never compares two separate images with one another. Ortiz does NOT detect a change of "magnitude between at least two images". Rather, Ortiz detects a change of magnitude of a scan signal with respect to the signal itself, as properly depicted in figure 12. Again, **Ortiz states that "each defect that shows in a screened image will cause a variation in the signals delivered from the relevant camera 36 to the associated motion detector circuit 112" at column 6, line 64.** Applicant's characterization of Ortiz is incorrect.

In order to facilitate the examiner's assertions with respect to the nature of a "video" signal, pages 23-24 of the book, Television Simplified (1973) are provided herewith. Referring to figure 2-7A at page 23, the "complete video signal for three scanned lines" is shown. The "visible part of the line" is the signal corresponding to the imaged object. Referring to the abscissa axis that depicts the "time" dimension, as soon as one line is scanned, the signal is blanked and then the next line of a frame (image) is scanned. When the entire frame has been scanned, the "vertical pulses, at the end of each field, are responsible for bringing the scanning beam back to the tom of the image" at page 23, section 2.5. This is depicted at page 24 in figure 2-8. The point being that the "signals" of video camera, such as the "visible part of the line" as depicted in figure 2-7A, are within a single frame, or image. Therefore, given that Ortiz

analyzes variations in a video "signal" as it arrives from the video camera, Ortiz is necessarily analyzing a single frame.

Applicant's Remark: "Ortiz et al. discloses that the motion detector circuits 112 detect the variations in the magnitude of a video signal as the video signal changes from an image that is defect free to a signal from an image containing a defect" and "this necessitates that the motion detector circuit 112 analyze at least two images" at page 11, section II.B.

Examiner's Response: Where does Ortiz disclose that the motion detector circuits 112 detect the variations in the magnitude of a video signal as the video signal "changes from an image that is defect free to a signal from an image containing a defect"? This not what Ortiz depicts at figure 12 or describes in the specification. Ortiz states, **"each defect that shows in a screened image will cause a variation in the signals delivered from the relevant camera 36 to the associated motion detector circuit 112" at column 6, line 64.** Again, looking at figure 12, Ortiz describes analyzing video signals that exist within a frame, or an image. Ortiz states that "the video signal, represented by the straight portion 80, has a uniform magnitude" and that "whenever a defect occurs ... the magnitude of the video signal changes, as shown by the various peaks 82" at column 7, lines 3-6. The video signal analyzed for changes, or "peaks", exist within a frame or single image of the video camera. Ortiz does not compare two separate time series images of the cameras. Granted, Ortiz discloses multiple cameras at figure 11, numerals 36. However, each camera and motion detector 112 combination is self-contained, and images are not shared between motion detectors. The only reason for the use of multiple

cameras it to acquire full coverage of the circumference of the coiled tube (i.e., "provide view of the entire bulk of the cable jacket" at Ortiz column 6, line 58). There is simply no disclosure in the Ortiz reference of the motion detector circuits 112 detecting the variations in the magnitude of a video signal as the video signal "changes from an image that is defect free to a signal from an image containing a defect"? The variation detected by Ortiz exists within a video signal within a single frame or image output by a single camera.

Applicant's Remark: "Having a detector associated with each camera may teach analyzing each video signal separately; however, it does not follow that each of the multiple images that make up an individual video signal are analyzed separately."

Examiner's Response: It is true, looking at figure 11, that Ortiz teaches multiple camera 36 and detector 112 combinations. Each of these is a self-contained analysis device that looks at a different field of view of the coiled tubing as described above. The examiner has already explained above, by pointing to specific figures and quotes from the Ortiz reference, how Ortiz analyzes each image separately. Regarding the applicant's statement that "it does not follow that each of the multiple images that make up an individual video signal are analyzed separately", it does not follow the individual images output from each camera 36 and input into its own, dedicated motion detector 112 are somehow processed "together". All aspects of figure 11 and its description in the Ortiz reference point to the individual processing of individual images be each camera and motion detector combination.

3. Claims 15, 17, 18, 21, 22, 23, 31 and 32 - Obvious in view of Ortiz et al. by (US 4,988,875 A) and Kanzaka et al. (US 5,680,473 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 15, 17, 18, 21, 22, 23, 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Ortiz et al. by (US 4,988,875 A) and Kanzaka et al. (US 5,680,473 A).

Regarding claims 15 and 31, even if Ortiz did not disclose a computer that analyzes individual images in order to determine the presence of a defect as argued by the application at response page 11, computer implement image analysis for purposes of defect detection is well known, and would have been obvious in view of Kanzaka as described below.

Kanzaka discloses a system in the same field of optical defect inspection (see figure 1), and in the same problem solving area of detecting and recording defects on a moving body (figure 1, numeral 1), comprising computer analysis of individual images in order to determine the presence of a defect (figure 1, numeral 3; "An image or video signal v from the video camera 2 is processed by an inspection machine 3 that is an electronic processor to inspect the existence

or not of defects such as flaws, dirty or the like on the surface of the inspected object" column 2, lines 59-62). In summary, Kanzaka inspects a material as it moves (i.e., figure 1, numeral 1) by capturing video images (figure 1, numeral 2), and analyzing the images to provide a defect "detection signal d" (column 3, line 2), produce "necessary data D" including "location … as well as size" (column 3, line 6), and provide a "composing signal C formed of the data D and the video signal v" (column 3, line 42) along with "the inspection date, product type, lot number etc." (column 3, line 48) and the "distance" in the "length direction of the inspected object" (column 3, lines 55-66). Kanzaka then sorts "the grades of the defects on the inspected object 1" (column 4, line 36). The Kanzaka system does essentially what Ortiz does via. the circuitry at figure 1, except that Kanzaka's system is computer implemented and much more comprehensive in the data it gathers.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to employ, as the defect detection and recording circuitry of Ortiz at figure 11, numerals 112, 116 and 126, the computer image analysis processor taught by Kanzaka (i.e., figure 1, numeral 3). One would be motivated to utilize the processor of Kanzaka for the following reasons:

- Computer processors are faster than discrete analog circuitry, and the algorithms can be modified, updated or changed without major hardware adjustments;

- In order to provide the operator with a complete set of the necessary data for the inspected object so that any defects and their locations are "readily apparent" (Kanzaka column 4, line 10), so that "an accurate judgment to the acceptance or rejection of the defect on the inspected object 1 can be made" (Kanzaka column 4, line 33A);

- To provide the additional benefit of sorting "the grades of the defects" (Kanzaka column 4, line 36) which further assists on operator in separating potential defects from serious defects;

- To minimize storage requirements by only storing the necessary data and images of defects ("minimum usage" at Kanzaka column 4, line 24);

- To provide an increase in the "inspection speed" (Kanzaka column 1, line 39) thus allowing the tubing to be inspected at a higher speed, thereby reducing inspection time; to

- Recognizing unwanted defects ("X marks … cannot be overlooked" at column 3, line 18) and ignoring innocuous defects ("O marks … may be ignored" at column 3, line 20) thus distinguishing between unwanted and innocuous defects to further improve accuracy by flagging innocuous defects as such, and directing the operator's attention to more serious defects that could cause failure, and reduce the downtime association with an operator having to review surface conditions that are not serious, and will not cause failure.

Regarding claim 17, Ortiz disclosed three CCD cameras surrounding the tubing ("three ... cameras" at column 6, line 55) and the Ortiz/Kanzaka combination does not change this. The combination utilizes the image signals from the Ortiz cameras as input into the computer analysis system of Kanzaka.

The requirements of claims 18 and 21 are met by the Ortiz and Kanzaka combination described above. That is, Kanzaka teaches a video stacker ("video signal v and the data D from the video processor unit 5 are mixed to provide a composing signal C which is delivered to a video signal recorder unit 8; this is done for each detected defect; thus, the detected defects are stacked on recorder unit 8) correlating images with a longitudinal position using a counter signal ("such distance data will be contained in the data D" at Kanzaka column 3, line 66). It would have been obvious to provide such stacked data regarding any defects detected in the Ortiz system for the same reasons cited above, as well as to be able to locate the actual defect on the tubing to either correct it, or removed it before it causes a failure in the field.

Regarding claim 22, the Kanzaka system as well as the Ortiz system both detect and output defects as the inspection articles are conveyed, and thus both detect defects in real time. Likewise, the Ortiz and Kanzaka combination detects defects in real time.

Regarding claim 23, Ortiz teaches storing video images for later defect identification at figure 11, numeral 126. The images are stored for later manual inspection by an operator. The Ortiz and Kanzaka combination does not change this aspect of Ortiz, except that a more

comprehensive collection of data concerning the defects are stored per Kanzaka figure 1, numeral 10, as described above.

Regarding claim 32, the Ortiz and Kanzaka combination provides a warning event (Kanzaka teaches storing only data regarding defects, when they are detected, at figure 1, numeral 10, displaying the data at numeral 12, as well as outputting the data on a strip chart at numeral 9, as depicted in figure 2).

(B) Response to Arguments:

Applicant's Remark: "The applicants repeat the remarks made above regarding Ortiz et al. and submit that Ortiz et al. clearly does not teach analyzing each image separately" at page 13, section III.B.2.

Examiner's Response: The examiner repeats his remarks made above regarding Ortiz et al.

Applicant's Remark: "The examiner conveniently makes the unsupported conclusion that the Kanzaka et al. "reference as a whole" teaches individual image analysis. However, the examiner cites nothing in the Kanzaka et al. that, "taken as a whole" would suggest this conclusion. Regardless, this is a flawed analysis" at page 14, section III.B.2.

Examiner's Response: Kanzaka discloses use of a "video camera" at figure 1, numeral 2, to capture images of moving body 1. Video cameras produce as sequence of images. At column 2, line 59, Kanzaka states that "an image or video signal v from the video camera 2 is processed by an inspection machine 3 that is an electronic processor ...". Here, Kanzaka's statement that "an image or video signal v from the video camera 2 is processed" can be interpreted in two ways, both of which meet the claimed requirements. First, assuming that the "or" in "an image or video signal" is meant as an alternative (i.e., that either an image or a video signal can be processed), then the claim requirement is met because an "image ... is processed by" the inspection machine 3. Second, assuming that the "or" in "an image or video signal" is meant as equating an "image" with the "video signal v" (i.e., that the term "image" is synonymous with "video signal v"), then the claim requirements are met as well, for the same reasons. Either way, Kanzaka discloses processing "an image" at column 2, line 59.

Applicant's Remark: "The applicants respectfully submit that a prima facie case of obviousness has not been established with respect to claims 15, 1 7, 18, 21, 22, 23, 31, and 32 because there is no motivation to combine Kanzaka et al. with Ortiz et al." at page 14, section III.B.2.

Examiner's Response: The motivation for the Ortiz and Kanzaka combination as presented by the examiner in the previous Office Action at pages 18-19, and carried over herein, is as follows:

"One would be motivated to utilize the processor of Kanzaka for the following reasons:"

"Computer processors are faster than discrete analog circuitry, and the algorithms can be modified, updated or changed without major hardware adjustments";

"In order to provide the operator with a complete set of the necessary data for the inspected object so that any defects and their locations are "readily apparent" (Kanzaka column 4, line 10), so that "an accurate judgment to the acceptance or rejection of the defect on the inspected object 1 can be made" (Kanzaka column 4, line 33A)";

"To provide the additional benefit of sorting "the grades of the defects" (Kanzaka column 4, line 36) which further assists on operator in separating potential defects from serious defects";

"To minimize storage requirements by only storing the necessary data and images of defects ("minimum usage" at Kanzaka column 4, line 24)";

"To provide an increase in the "inspection speed" (Kanzaka column 1, line 39) thus allowing the tubing to be inspected at a higher speed, thereby reducing inspection time";

"Recognizing unwanted defects ("X marks … cannot be overlooked" at column 3, line 18) and ignoring innocuous defects ("O marks … may be ignored" at column 3, line 20) thus distinguishing between unwanted and innocuous defects to further improve accuracy by flagging

innocuous defects as such, and directing the operator's attention to more serious defects that could cause failure, and reduce the downtime association with an operator having to review surface conditions that are not serious, and will not cause failure".

Despite an allegation of deficient "motivation", these above motivational statements as presented in the previous Office Action remain unaddressed by the applicant.

Applicant's Remark: "Ortiz et al. teaches using a computer to analyze not only the outside, but also specifically on the inside of the inspected object. Ortiz et al. is very specific about this ability as a distinct advantage of the Ortiz et al. system. Kanzaka et al., however, only teaches a processor capable of determining the existence or not of defects on the surface of the inspected object. Obviously, using the processor of Kanzaka et al. with the Ortiz et al. system would not give the Ortiz et al. system the ability to determine the existence of defects on the inside ..." at page 14, section III.B.2.

Examiner's Response: The Ortiz and Kanzaka is not a literal combination. The examiner is not suggesting that Kanzaka's processor at figure 1, numeral 3 should be lifted exactly as configured in the Kanzaka reference and dropped into the Ortiz system and that it would work flawlessly.. Rather, the examiner is relying upon the Kanzaka reference as a "teaching" of the use of a defect inspection "processor" based system. The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any

one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

4. Claim 41 - Obvious in view of Ortiz et al. by (US 4,988,875 A), Kanzaka et al. (US 5,680,473 A) and Puffer (US 4,563,095 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 41 is unpatentable over the combination of Ortiz et al. by (US 4,988,875 A) and Kanzaka et al. (US 5,680,473 A) as applied to claim 31, and further in combination with Puffer (US 4,563,095 A).

While the Ortiz and Kanzaka combination processes images to detect defects, the combination does not teach determining if the size of a discrete anomaly exceeds a user-defined threshold.

Puffer discloses a system for visually inspecting coiled tubing (figure 1), comprising determining if the size of a discrete anomaly exceeds a user-defined threshold (figure 2, numeral 52; "counter 52 increments each time a pixel senses light above the threshold level, and provides an output 55 to an annunciator or alarm 56 each time [a] preselected count (i.e., 16) is reached"

where "the count is one indicative of a flaw such as a pip 22" at column 6, lines 1-5; "the cumulative count during each scanning frame corresponds to the size of the image on detector 38, and may correspond to the size of a pip 22" at column 6, lines 10-14)

It would have been obvious at the time the invention was made to one of ordinary skill in the art to adapt the flaw detection processor of the Ortiz and Kanzaka combination to determine if the size of a discrete anomaly exceeds a user-defined threshold as taught by Puffer, in order to provide a size criteria for the indication of real defects, thus preventing the false indication of a defect ("falsely indicate" at Puffer column 6, line 35).

(B) Response to Arguments:

At page 15, section III.C. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

5. <u>Claim 24 - Obvious in view of Ortiz et al. by (US 4,988,875 A), Kanzaka et al. (US 5,680,473 A) and Newman (US 6,321,596 B1).</u>

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Ortiz et al. by (US 4,988,875 A) and Kanzaka et al. (US 5,680,473 A) as applied to claim 15 above, and further in combination with Newman (US 6,321,596 B1).

Claim 24 requires a longitudinal stripe on the outer surface of the tubing. The remainder of the claim, "for the purpose of", is an intended use limitation and does not constitute a positively recited structure element, or a step. Thus, is afforded no weight.

The Ortiz and Kanzaka combination does not teach a longitudinal stripe on the outer surface of the tubing.

Newman teaches a system for inspecting coiled tubing (figure 1) comprising a longitudinal stripe on the outer surface of the tubing ("a visible line is marked along the coiled tubing" at column 3, line 42). The purpose of this stripe as described by Newman is as a reference mark, for visual monitoring via. a camera, from which to monitor tubing characteristics such as rotation ("coiled tubing can be marked and locations of markings can be measured in a variety of ways", "rotational orientation of the line ... is monitored visually, with ... camera(s)" at column 3, lines 40-45; "take discrete rotational measurements at one or at a plurality of locations on a length of coiled tubing while it is being unspooled" at column 3, line 23; the rotation of the tube is a measure of "fatigue damage" at column 4, line 25).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the tubing of the Ortiz and Kanzaka combination with at least one longitudinal stripe for purposes of measuring rotational orientation of the tubing, thereby ensuring that the tubing has not been fatigued by undue amounts of rotation.

(B) Response to Arguments:

At page 15, section III.D. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

6. Claim 25 - Obvious in view of Ortiz et al. by (US 4,988,875 A), Kanzaka et al. (US 5,680,473 A) and Hametner et al. (US 5,046,852 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Ortiz et al. by (US 4,988,875 A) and Kanzaka et al. (US 5,680,473 A) as applied to claim 15 above, and further in combination with Hametner et al. (US 5,046,852 A).

Claim 25 requires the pattern recognition software to measure outside diameter of the tubing and indicate whether it is outside a user-defined tolerance.

The Ortiz and Kanzaka combination does not teach the measurement of diameter.

Hametner discloses a system in the same field of optical tube inspection ("tube material" at column 1, line 52; "optically scanned" at column 2, line 36), comprising the pattern recognition software (the system is computer implemented, and measurements are made by

image processing) to measure outside diameter of the tubing ("diameter" at column 1, line 53, and elsewhere) and indicate whether it is outside a user-defined tolerance ("conforms to a desired configuration" at column 2, line 35; "desired configuration within a predetermined tolerance" at column 2, line 44).

It would have been obvious at the time the invention was made to one of ordinary skill in the art adapt the pattern recognition software of the Ortiz and Kanzaka combination to include, as a further measurement of the tube's physical condition, the outside diameter as taught by Hametner, in order to ensure further ensure conformity with design standards and to ensure a proper tube thickness to prevent failure during use.

(B) Response to Arguments:

At pages 15-16, section III.E. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

7. <u>Claim 16 - Obvious in view of Ortiz et al. by (US 4,988,875 A), Kanzaka et al. (US 5,680,473 A) and Greenwood et al. (US 3,770,111 A).</u>

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Ortiz et al. by (US 4,988,875 A) and Kanzaka et al. (US 5,680,473 A) as applied to claim 15 above, and further in combination with Greenwood et al. (US 3,770,111 A).

The Ortiz and Kanzaka combination does not teach the use of fiber optic image devices.

Greenwood discloses an optical inspection system wherein Greenwood teaches the use of fiber optic imaging devices ("fiber light guides" at column 3, line 58).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the fiber optic image devices of Greenwood, in order to capture the images required by the Ortiz and Kanzaka combination, in order to "gather light over a much larger portion" of the tubing (Greenwood, column 4, line 1) with "a considerable decrease in optical complexity" (Greenwood, column 4, line 4), thereby providing an accurate and detailed image using a less complex, less prone to failure and lower cost image system.

(B) Response to Arguments:

At page 16, section III.F. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

8. Claims 19 and 20 - Obvious in view of Ortiz et al. by (US 4,988,875 A), Kanzaka et al. (US 5,680,473 A) and Chiu et al. (US 6,031,931 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Ortiz et al. by (US 4,988,875 A) and Kanzaka et al. (US 5,680,473 A) as applied to claim 18 above, and further in combination with Chiu et al. (US 6,031,931 A).

While the Ortiz and Kanzaka combination teaches a "position detector 1' such as a rotary encoder" (Kanzaka column 3, line 60) for detecting the position of the tubing in the movement direction, Ortiz and Kanzaka does not teach disabling or enabling the inspection system based on sensor speed.

Chiu discloses a system for inspecting an elongated body in motion (figure 3), comprising a counter ("cycle detector" and "encoder" at column 6, line 5) receiving location data indicating a position of a defect ("position" at column 6, line 28) and disabling or enabling the inspection system based on sensor speed ("beginning of a cycle" at column 6, line 6; "synchronize camera operation with movement" at column 6, line 37).

It would have been obvious at the time the invention was made to one of ordinary skill in the art utilize the rotary encoder of the Ortiz and Kanzaka combination, to enable and disable the

image capture and inspection in order to automatically begin and continuously synchronize the camera operation with the movement to obviate the capture of to many or to few images for inspection.

(B) Response to Arguments:

At page 16, section III.G. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

9. Claims 1-3, 5-7 and 9 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), and Morrison et al. (US 5,033,096 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-3, 5-7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A) and Kanzaka et al. (US 5,680,473 A), and further in combination with Morrison et al. (US 5,033,096 A).

Regarding claim 1, McCoy discloses an inspection system for coiled tubing employed in a well (figure 4; "as the coiled tubing is unwound from the reel" at column 6, line 60; "dents, wall thinning, cracks" at column 5, line 33), comprising:

a sensing device (figure 4, numeral 52) sensing a condition of the coiled tubing surface (figure 4, numeral 16) as the coiled tubing is being injected into or removed from a well ("as the coiled tubing is unwound from the reel" at column 6, line 60).

While McCoy contemplates any type of sensing device to achieve the desired inspection results (see "particular coiled tubing and test apparatus are neither the present invention nor limiting ..." at column 5, line 42), McCoy does not teach the remaining elements of claim 1 that are directed to image inspection. These elements are addressed in the description of the secondary teachings below.

Kanzaka discloses a system in the same field defect inspection (see figure 1), and in the same problem solving area of detecting and recording defects on a moving body (figure 1, numeral 1), comprising:

An imaging device recording video signals of a segment of a moving body to be inspected (figure 1, numeral 2);

a conductor transmitting the video signals to a flaw detection processor (figure 1, signal "v"); and

a program in the processor configured to execute pattern recognition software and analyze each image separately to detect discrete anomalies on the object (figure 1, numeral 3; "An image or video signal v from the video camera 2 is processed by an inspection machine 3

that is an electronic processor to inspect the existence or not of defects such as flaws, dirty or the like on the surface of the inspected object" column 2, lines 59-62).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to employ, as the sensor and computer required by McCoy at figure 4, numerals 52 and 54, the camera and image analysis method of taught by Kanzaka (i.e., figure 1, numeral 3) in order to detect flaws on the coiled tubing of McCoy. One would be motivated to utilize the camera and image analysis method of Kanzaka for the following reasons:

- In order to provide the operator with a complete set of the necessary data for the inspected object so that any defects and their locations are "readily apparent" (Kanzaka column 4, line 10), so that "an accurate judgment to the acceptance or rejection of the defect on the inspected object 1 can be made" (Kanzaka column 4, line 33A);
- To provide the additional benefit of sorting "the grades of the defects" (Kanzaka column 4, line 36) which further assists on operator in separating potential defects from serious defects;
- To minimize storage requirements by only storing the necessary data and images of defects ("minimum usage" at Kanzaka column 4, line 24);
- To provide an increase in the "inspection speed" (Kanzaka column 1, line 39) thus allowing the tubing to be inspected at a higher speed, thereby reducing inspection time;
- To recognize unwanted defects ("X marks … cannot be overlooked" at Kanzaka column 3, line 18) and ignore innocuous defects ("O marks … may be ignored" at Kanzaka

column 3, line 20) thus distinguishing between unwanted and innocuous defects to further improve accuracy by flagging innocuous defects as such, and directing the operator's attention to more serious defects that could cause failure, and reducing the downtime associated with an operator having to review surface conditions that are not serious, and will not cause failure.

The above McCoy and Kanzaka combination teaches the transmission of video images (figure 1, "v") of the coiled tubing from a video camera (i.e., figure 1, numeral 2 of Kanzaka) to a flaw detection unit (i.e., figure 1, numeral 4 of Kanzaka). While the flaw detection unit receives, accepts and processes of the video signals to detect defects in individual images, details of how the images are converted from a "video" stream to individual images for processing are left out. This is because such rudimentary details are well within the skill level of one of ordinary skill in the art. Therefore, the McCoy and Kanzaka combination does not teach:

An image grabber generating the images of the tubing segment from the video signals.

Morrison discloses a defect detection system (figures 1 and 2), wherein he addresses the same problem of capturing and processing images of a moving object (figure 1, numeral 7), comprising:

an image grabber input device (figure 1, numeral 9) receiving the video signals (figure 1, numeral 8) and generating sequential images of the moving object's surface from the video

("captured signals corresponding to each frame of video signals are preferably digitized ..." at column 4, line 38).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the McCoy and Kanzaka, by providing the flaw detection unit (i.e., Kanzaka figure 1, numeral 4) with the video camera/frame grabber arrangement as taught by Morrison (i.e., Morrison figure 1, numerals 6, 8 and 9) to accept and digitize the video signal into discrete images for subsequent analysis and flaw detection. One skilled in the art would be motivated to make this modification for the following reasons:

- In order to process individual images as is required by the Ortiz and Kanzaka combination (i.e., "an image ... is processed" at Kanzaka column 2, line 59) by converting the input video signal, which is a continuous signal representing a plurality of images in serial sequence, into individual digitized images;
- The video camera and frame grabber of Morrison are commonly available, off-the-shelf items as described at section 6 of Morrison (i.e., column 7, lines 5-51), thus reducing the cost associated with specialize, custom camera and processors;
- The ability to "collect the video information sufficiently quickly that the spatial resolution of the camera is not degraded, and to digitized the information into a large range of numbers representing brightness or gray levels" (Morrison, column 7, line 10), thus producing an accurate image in a short period of time; and

- Because of the ability to store the images "in a dedicated area of memory" (Morrison, column 7, line 27) which offers "higher overall system speed" (Morrison, column 7, line 34), thus providing the McCoy and Kanzaka combination with the ability to accurately process more images to ensure that no defects on the moving tubing are missed.

Regarding claim 5 specifically, the frame storage of Morrison stores subsequent frames, and is thus a stacker.

Regarding claims 2 and 3 are met by the above McCoy and Kanzaka combination. That is, Kanzaka discloses, as part of his flaw detection processor (i.e., figure 1, numeral 3), receives location data indicating a position of a defect ("location thereof" at column 3, line 6), and stamps the coordinates of the defect onto the image of the defect ("composing section 6, the video signal v and the data D ... are mixed to provide a composing signal C which is delivered to a video signal recorder" at column 3, line 37). It would have been obvious at the time the invention was made to one of ordinary skill in the art to mix the location coordinates and images of the above McCoy, Kanzaka and Morrison combination as taught by Kanzaka in order to have a log of the actual images along with locations for future review and analysis of defects, and to pinpoint exactly where on the tubing defects are located for longevity analysis are repair/correction of the tubing.

Regarding claim 6, the limitations therein are met by the McCoy, Kanzaka and Morison combination as described above. That is, in the above combination, the Kanzaka defect

detection processor is used to recognize and store defects in the McCoy system. Kanzaka teaches as part of that processing recognizing and classifying defects ("the grades of the defects" at Kanzaka column 4, line 36).

Regarding claim 7, McCoy inspects for "cracks" at column 5, line 33 and the above combination does not change that.

Regarding claim 9, the McCoy, Kanzaka and Morrison generates a warning signal (Kanzaka figure 1, numeral 9 and/or 12).

(B) Response to Arguments:

Applicant's Remark: Applicant repeats his arguments that "Kanzaka et al. does not teach analyzing or processing each image separately" at page 17, section III.H.2. of the remarks.

Examiner's Response: The examiner has addressed applicant's arguments regarding Kanzaka above.

Applicant's Remark: "Kanzaka et al. teaches analyzing the entire surface of the inspected device visible to the camera for defects such as cracks, etc. The processor of Morrison et al. only calculates, and only can calculate, the position of the edge of the inspected device. The

Morrison et al. processor does not and cannot analyze the entire visible surface of the inspected device for defects" at page 17, section III.H.2. of the remarks.

Examiner's Response: Morrison is not relied upon by the examiner as analyzing the "entire visible surface of the inspected device" as alleged by the applicant. Rather, Morrison is relied upon as teaching an image grabber for digitizing a video signal into a discrete images for subsequent analysis and review. The images themselves come from the McCoy and Kanzaka combination. In the McCoy, Kanzaka and Morrison rejection above, McCoy contemplates any type of sensing device to achieve the desired inspection results (see "particular coiled tubing and test apparatus are neither the present invention nor limiting ..." at column 5, line 42), but does not teach image inspection. Kanzaka is relied upon as teaching image inspection (i.e., inspection for flaws or imperfections of a moving body using images). While Kanzaka teaches video image signals to detect defects in individual images, details of how the images are converted from a "video" stream to individual images for processing are left out. This is because such rudimentary details are well within the skill level of one of ordinary skill in the art. Morrison is relied upon as teaching an image grabber input device (figure 1, numeral 9) receiving the video signals (figure 1, numeral 8) and generating sequential images of the moving object's surface from the video ("captured signals corresponding to each frame of video signals are preferably digitized ..." at column 4, line 38). Therefore, Morrison need not teach an analysis of "the entire visible surface of the inspected device", as this is taught by Kanzaka. Furthermore, this is not even a claim limitation.

10. <u>Claim 43 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Morrison et al. (US 5,033,096 A) and Terry et al. (US 6,296,066 B1).</u>

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), and Morrison et al. (US 5,033,096 A) as applied to claim 1, and further in combination with Terry et al. (US 6,296,066 B1).

The McCoy, Kanzaka and Morrison combination does not teach the specific limitation regarding the coiled tubing as required by claims 43, including an outer-wear layer; and a contrasting layer beneath the wear layer; wherein if the outer wear layer is worn away, the contrasting layer becomes visible as a contrasting feature on the tubing.

Terry discloses a coiled tubing (figure 1, numeral 20) comprising: an outer wear layer ("wear layer 36" at column 10, line 22); and a contrasting layer beneath the wear layer ("underlying load carrying layers 34" at column 10, line 27); wherein if the outer wear layer is worn away, the contrasting layer becomes visible as a contrasting feature on the tubing (the wear layer "can be of a different fiber and color making it easy to determine the wear locations" at column 10, line 33).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the coiled tubing taught by Terry, as the tubing for well deploying and monitoring require by McCoy, in order to make it "easy to determine the wear locations" (Terry, column 10, line 33) due to the color differences between the outer and under layers.

(B) Response to Arguments:

At page 18, section III.I. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

11. Claims 44 and 45 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Morrison et al. (US 5,033,096 A), Terry et al. (US 6,296,066 B1) and Newman (US 6,321,596 B1).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 44 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Morrison et al.

(US 5,033,096 A) and Terry et al. (US 6,296,066 B1) as applied to claim 43, and further in combination with Newman (US 6,321,596 B1).

While the McCoy, Kanzaka, Morrison and Terry combination teaches the inspection of coiled tubing employed in a well (McCoy figure 4; "as the coiled tubing is unwound from the reel" at column 6, line 60; "dents, wall thinning, cracks" at column 5, line 33), McCoy does not teach the outermost layer individual distinguishable stripes.

Newman teaches a system for inspecting coiled tubing (figure 1), comprising longitudinal stripes on the outer surface of the tubing ("series of visible lines ... along its length" at column 3, line 43). The purpose of the stripes described by Newman is as a reference mark, for visual monitoring via. a camera, from which to monitor tubing characteristics such as rotation ("coiled tubing can be marked and locations of markings can be measured in a variety of ways", "rotational orientation of the line ... is monitored visually, with ... camera(s)" at column 3, lines 40-45; "take discrete rotational measurements at one or at a plurality of locations on a length of coiled tubing while it is being unspooled" at column 3, line 23; the rotation of the tube is a measure of "fatigue damage" at column 4, line 25).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the tubing of the McCoy, Kanzaka, Morrison and Terry combination with longitudinal stripes as taught by Newman, in order to measure the rotational orientation of the tubing as a further indicator of "fatigue", thus improving the accuracy of the inspection by providing the additional criteria of rotational fatigue.

(B) Response to Arguments:

At page 18, section III.J. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

12. Claim 8 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Morrison et al. (US 5,033,096 A) and Hametner et al. (US 5,046,852 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), and Morrison et al. (US 5,033,096 A) as applied to claim 1, and further in combination with Hametner et al. (US 5,046,852 A).

Claim 8 requires the program to measure the diameter of the tubing.

The McCoy, Kanzaka and Morrison combination does not teach the measurement of diameter.

Hametner discloses a system in the same field of optical tube inspection ("tube material" at column 1, line 52; "optically scanned" at column 2, line 36), comprising the pattern

recognition software (the system is computer implemented, and measurements are made by image processing) to measure outside diameter of the tubing ("diameter" at column 1, line 53, and elsewhere) and indicate whether it is outside a user-defined tolerance ("conforms to a desired configuration" at column 2, line 35; "desired configuration within a predetermined tolerance" at column 2, line 44).

It would have been obvious at the time the invention was made to one of ordinary skill in the art adapt the flaw detection processor of the McCoy, Kanzaka and Morrison combination to included, as a further measurement of the tube's physical condition, the outside diameter as taught by Hametner, in order to ensure further ensure conformity with design standards and to ensure a proper tube thickness to prevent failure during use.

(B) Response to Arguments:

At page 19, section III.K. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

13. <u>Claim 4 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Morrison et al. (US 5,033,096 A) and Endsley et al. (US 6,05,613 A).</u>

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A) and Morrison et al. (US 5,033,096 A) as applied to claim 1, and further in combination with Endsley et al. (US 6,05,613 A).

The McCoy, Kanzaka and Morrison combination does not teach 640X480 camera resolution with 8 bits per color.

Endsley discloses an CCD camera comprising 640X480 resolution with 8 bits per color ("Kodak KAI-0320CM", "640 columns and 480 rows", "8-bit" at column 3, lines 26, 28 and 36).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the CCD camera taught by Endsley, as the camera required by the McCoy, Kanzaka and Morrison combination, in order to keep the system cost low by using a standard, commercially available and off-the-shelf camera, while providing a high quality 640X480 image to ensure an accurate inspection.

(B) Response to Arguments:

At page 19, section III.L. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

14. Claim 26 - Obvious in view of Puffer (US 4,563,095 A) and Morrison et al. (US 5,033,096 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Puffer (US 4,563,095 A) and Morrison et al. (US 5,033,096 A).

Regarding claim 26, Puffer discloses a system for automated tubing inspection (figure 1), comprising:

a processing circuit (figure 1, numeral 44);

a camera producing a sequence of images ("CID detector array" at column 5, line 41; this detector produces a continuous sequence of frames; see "scanning raster" at column 5, line 61 and "each frame" at column 6, line 6) of a tubing surface (figure 1, numeral 16; "irregularities in the cable coating" at column 1, line 36; Puffer inspects a cable coating, and the coating itself is a tubular member in that it is hollow on the inside per se.; the claim is open ended and does not preclude the coating, or tubing from being filled, such as with a conductor in the case of Puffer),

a pattern classifier circuit (figure 2, numerals 48, 54 and 52) reading each image separately ("each frame" at column 6, line 7), extracting discrete anomalies of the tubing from the image and comparing the sizes of the anomalies against a user-defined threshold (figure 2,

numeral 52; "counter 52 increments each time a pixel senses light above the threshold level, and provides an output 55 to an annunciator or alarm 56 each time [a] preselected count (i.e., 16) is reached" where "the count is one indicative of a flaw such as a pip 22" at column 6, lines 1-5; "the cumulative count during each scanning frame corresponds to the size of the image on detector 38, and may correspond to the size of a pip 22" at column 6, lines 10-14); and

generating an interrupt indicating that a defect has been located if the pattern classification circuit determines that a size of a discrete anomaly does not fall within the user-defined threshold (This limitation is met in at least two ways: First, whenever the pip size threshold is met, the normal process is interrupted by the recording of the pip size; e.g., see "provide a record of pip sizes during each scanning frame" at column 6, line 15; Second, as mentioned above, an alarm is sounded when the pip size meets the threshold; e.g., see "actuating alarm 56 only if it accumulates the requisite count (i.e., 16)" at column 6, line 31).

Puffer does not teach a computer processor having pattern recognition software do perform the extract the discrete anomalies, and puffer does not teach a separate output device producing video signals of the tubing and an input device receiving the video signals and generating sequential images of the tubing surface from the video input.

Morrison discloses a defect detection system (figures 1 and 2), wherein he addresses the same problem of capturing and processing images of a moving object (figure 1, numeral 7), comprising:

a computer processor having pattern recognition software ("software" at column 4, line 34) extracting discrete anomalies (figure 1, numeral 10; "abrupt change in the brightness" at column 2, line 57), an output device producing video signals of the inspection object (figure 1,

numeral 6; "video camera" at column 4, line 23), an input device receiving the video signals and generating sequential images of the tubing surface from the video input (figure 1, numeral 9; "frame grabber" at column 4, line 33). Specifically, Morrison teaches an image grabber input device (figure 1, numeral 9) receiving the video signals (figure 1, numeral 8) and generating sequential images of the moving object's surface from the video ("captured signals corresponding to each frame of video signals are preferably digitized ..." at column 4, line 38).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the image capture and processing circuit of Puffer (figure 1, numeral 44), by capturing images and implementing the defect detection processing of Puffer utilizing the video camera, frame grabber and pattern recognition software as taught by Morrison. One skilled in the art would be motivated to make this modification for the following reasons:

- In order to conveniently capture individual images for processing as required by Puffer quickly and efficiently without the need for any specialized hardware as currently disclosed by Puffer;
- The video camera and frame grabber of Morrison are commonly available, off-the-shelf items as described at section 6 of Morrison (i.e., column 7, lines 5-51), thus reducing the cost associated with specialize, custom camera and processors;
- The ability to "collect the video information sufficiently quickly that the spatial resolution of the camera is not degraded, and to digitized the information into a large range of numbers representing brightness or gray levels" (Morrison, column 7, line 10), thus producing an accurate image in a short period of time; and

- Because of the ability to store the images "in a dedicated area of memory" (Morrison, column 7, line 27) which offers "higher overall system speed" (Morrison, column 7, line 34), thus providing the Puffer and Morrison combination with the ability to accurately process more images to ensure that no defects on the moving tubing are missed.

(B) Response to Arguments:

Applicant's Remarks: "The applicants respectfully submit that a prima facie case of obviousness has not been established because there is no motivation to combine Puffer with Morrison et al." and "The Morrison et al. processor does not and cannot analyze the entire visible surface of the inspected device for defects. If the Morrison et al. processor was used, Puffer would obviously not be able to detect defects on the entire visible surface of the inspection object" at page 20, section III.M.2. of the arguments.

Examiner's Response: In the Puffer and Morrison combination advanced above, Morrison is relied upon as teaching the concept of a computer processor having pattern recognition software as Puffer teaches a more antiquated design as depicted in figure 2. The motivation for the combination as advanced in the previous Office Action and repeated above is as follows:

"One skilled in the art would be motivated to make this modification for the following reasons:"

"In order to conveniently capture individual images for processing as required by Puffer quickly and efficiently without the need for any specialized hardware as currently disclosed by Puffer";

"Because of the ability to store the images "in a dedicated area of memory" (Morrison, column 7, line 27) which offers "higher overall system speed" (Morrison, column 7, line 34), thus providing the Puffer and Morrison combination with the ability to accurately process more images to ensure that no defects on the moving tubing are missed."

Thus, the fact that Morrison does not teach the exact image processing requirements of Puffer is irrelevant, as the "teaching" relied upon is that of a processor running on software (Morrison) for performing the processing disclosed by Puffer at figure 2.

Applicant's Remarks: "Puffer does not teach creating an image of the tubing surface" at page 21, section III.M.2. of the arguments.

Examiner's Response: Puffer discloses a camera 38 taking an image of a tubing surface 16 as seen in figure 1. Light reflected off the tubing is captured (i.e., imaged) by the camera (i.e., "images the scattered light on the active surface of the detector array 38" at column 4, line 67). More specifically, Puffer's camera "employs an orthogonal grid of 248 pixels by 244 pixels" at column 5, line 42. For reading the image from the camera, the grid is raster scanned ("scanning

the detector array 38" at column 5, line 44; "scanning raster for scanning the pixel outputs of detector 38" at column 5, line 61. Clearly, a 248 X 244 pixel image is scanned out, or read for Puffer's camera. Given that the image represented by the pixels is that of the tubing, then Puffer disclosed "creating an image of the tubing surface". It is this raster scanned 248 X 244 pixel image that is used in the threshold analysis described at column 5, line 65, whereby pixels exceeding an intensity threshold are counted and an alarm is sounded when a preselected count is reached at column 6, line 4. The counter is reset and this process is repeated for each "frame", or image. That is, "the counter 52 is reset by a signal at the end of each frame" at column 6, line 7. Thus, Puffer teaches defect detection within images, or frames representing a tubing surface.

Applicant's Remarks: "Puffer does not teach comparing the size of any anomaly against a user-defined threshold" at page 22, section III.M.2. of the arguments.

Examiner's Response: Puffer counts pixels exceeding an intensity threshold (i.e., "increments each time a pixel senses light above the threshold" at column 6, line 1). Puffer discloses a count threshold ("preselected count" at column 6, line 4), above which an alarm is sounded ("alarm" at column 6, line 3). The count threshold is related to the "size" of an anomaly ("the cumulative count during each scanning frame corresponds to the size of the image on detector 38, and thus may corresponds to the size of a pip 22" at column 6, line 12. Thus, through Puffer's "count", a "size" of a "pip" (i.e., a defect) is compared to a threshold ("preselected count").

15. <u>Claims 27 and 29 - Obvious in view of Puffer (US 4,563,095 A), Morrison et al. (US 5,033,096 A), Ortiz et al. (US 4,988,875 A) and Vild et al. (US 4,123,708 A).</u>

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Puffer (US 4,563,095 A) and Morrison et al. (US 5,033,096 A) as applied to claim 26 above, and further in combination with Ortiz et al. (US 4,988,875 A) and Vild et al. (US 4,123,708 A).

Regarding claim 27, while the Puffer and Morrison combination records data pertaining to identified defects (i.e., Puffer figure 2, numeral 58), the combination does not teach:

An input for receiving location of data indicating the position from which images are taken, and generating an interrupt to transmit an image containing the defect and the corresponding location data to an output device.

Ortiz discloses a system for inspecting coiled tubing (figure 11), comprising an input for receiving location of data indicating the position from which images are taken (figure 11, numeral 128; "location of the cable area being documented" at column 7, line 40), and generating an interrupt to transmit an image containing the defect and the corresponding location

data to an output device (whenever a defect is identified by the motion detectors at figure 11, numeral 112, an interrupt is sent via. 116 to record the images of the defect along with the aforementioned location data; see "video signals representing the images of the defective segment ... are transmitted ... to a video recording system" at column 7, lines 25-30; "the information includes ... location" at column 7, line 39).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the Puffer and Morrison combination with an image and location data recording system for recording the images and the location of the defective portions of the tubing as taught by Ortiz, so that "those images can be evaluated either visually or, by image processing for the purpose of eliminating some cable locations for close inspection" (Ortiz column 7, line 56) thereby filtering out false defects so that real defects can be re-examined more closely to ensure accuracy.

The Puffer, Morrison and Ortiz combination, while recording location data, does not teach markings on the coiled tubing to provide location data on the coiled tubing.

Vild discloses a system for inspecting tubes for flaws ("flaw inspection" and "pipe" at column 3, lines 35 and 37), comprising markings on the coiled tubing to provide location data on the coiled tubing ("marking of the location of the defect" at column 5, line 50; "marking gun" at column 6, line 5).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Puffer, Morrison and Ortiz combination, to provide a visual "indication not only of the longitudinal location of the defect, but also an indication of the circumferential

location of the defect" (Vild column 5, line 53), thereby providing the combination with an easy, intuitive way from which to locate the defects both in the images and on the actual pipe.

Regarding claim 29, while the Puffer, Morrison, Ortiz and Vild combination teaches the recording of defect information (i.e., Puffer figure 2, numeral 58), the combination does not teach a monitor.

Morrison further teaches a monitor for viewing the defect information (figure 1, numeral 11)..

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide Puffer with a monitor as taught by Morrison so that an operator can easily and readily view the stored defect information to review and possibly confirm the accuracy of the results.

(B) Response to Arguments:

At page 22, section III.N. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

16. <u>Claims 28 and 30 - Obvious in view of Puffer (US 4,563,095 A), Morrison et al. (US 5,033,096 A), Ortiz et al. (US 4,988,875 A), Vild et al. (US 4,123,708 A) and Kanzaka et al. (US 5,680,473 A).</u>

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 28 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Puffer (US 4,563,095 A), Morrison et al. (US 5,033,096 A), Ortiz et al. (US 4,988,875 A) and Vild et al. (US 4,123,708 A) as applied to claim 27 above, and further in combination with Kanzaka et al. (US 5,680,473 A).

Regarding claim 28, while the Puffer, Morrison, Ortiz and Vild combination teaches the recording of defect information (i.e., Puffer figure 2, numeral 58), the combination does not teach a printer.

Kanzaka discloses a defect inspection system comprising recording defect information on paper via. a printer (figure 1, numeral 9 and figure 2).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to record the defect information (e.g., location) each time the defect alarm is generated by Puffer in order to provide a permanent record of both the defect location so that an operator can view and further classify the defects to ensure "an accurate judgment to the acceptance or rejection of the defect on the inspected object" as described by Kanzaka, at column 4, lines 26-38, and to provide an intuitive indication of where the defects are in relation to the moving tubing (see figure 2, and column 3, lines 8-15).

Regarding claim 30, Kanzaka discloses his classifier as recognizing unwanted defects ("X marks ... cannot be overlooked" at column 3, line 18) and ignoring innocuous defects ("O marks ... may be ignored" at column 3, line 20).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to train the Puffer, Morrison, Ortiz and Vild combination to distinguish between unwanted and innocuous defects as taught by Kanzaka, to further improve accuracy by flagging innocuous defects as such, and directing the operator's attention to more serious defects that could cause failure, and reduce the dowtime association with an operator having to review surface conditions that are not serious, and will not cause failure.

(B) Response to Arguments:

At pages 22-23, section III.O. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

17. Claim 13 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Newman (US 6,321,596 B1) and Reis et al. (US 4,311,905 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A) and Kanzaka et al. (US 5,680,473 A), and further in combination with Newman (US 6,321,596 B1) and Reis et al. (US 4,311,905 A).

Regarding claim 13, McCoy discloses an inspection system for coiled tubing employed in a well (figure 4; "as the coiled tubing is unwound from the reel" at column 6, line 60; "dents, wall thinning, cracks" at column 5, line 33), comprising:

a sensing device (figure 4, numeral 52) sensing a condition of the coiled tubing surface (figure 4, numeral 16) as the coiled tubing is being injected into or removed from a well ("as the coiled tubing is unwound from the reel" at column 6, line 60).

While McCoy contemplates any type of sensing device to achieve the desired inspection results (see "particular coiled tubing and test apparatus are neither the present invention nor limiting ..." at column 5, line 42), McCoy does not teach the remaining elements of claim 1 that are directed to image inspection. These elements are addressed in the description of the secondary teachings below.

Kanzaka discloses a system in the same field defect inspection (see figure 1), and in the same problem solving area of detecting and recording defects on a moving body (figure 1, numeral 1), comprising:

An imaging device (figure 1, numeral 2) recording video signals (figure 1, "v") of a segment of a moving body to be inspected (figure 1, numeral 1);

a flaw detection processor receiving the video signals (figure 1, numeral 3); and

a program in the processor configured to execute pattern recognition software and analyze each image separately to detect discrete anomalies on the object (figure 1, numeral 3; "An image or video signal v from the video camera 2 is processed by an inspection machine 3 that is an electronic processor to inspect the existence or not of defects such as flaws, dirty or the like on the surface of the inspected object" column 2, lines 59-62).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to employ, as the sensor and computer required by McCoy at figure 4, numerals 52 and 54, the camera and image analysis method of taught by Kanzaka (i.e., figure 1, numeral 3) in order to detect flaws on the coiled tubing of McCoy. One would be motivated to utilize the camera and image analysis method of Kanzaka for the following reasons:

In order to provide the operator with a complete set of the necessary data for the inspected object so that any defects and their locations are "readily apparent" (Kanzaka column 4, line 10), so that "an accurate judgment to the acceptance or rejection of the defect on the inspected object 1 can be made" (Kanzaka column 4, line 33A);

To provide the additional benefit of sorting "the grades of the defects" (Kanzaka column 4, line 36) which further assists on operator in separating potential defects from serious defects;

To minimize storage requirements by only storing the necessary data and images of defects ("minimum usage" at Kanzaka column 4, line 24);

To provide an increase in the "inspection speed" (Kanzaka column 1, line 39) thus allowing the tubing to be inspected at a higher speed, thereby reducing inspection time; to

Recognizing unwanted defects ("X marks … cannot be overlooked" at column 3, line 18) and ignoring innocuous defects ("O marks … may be ignored" at column 3, line 20) thus

distinguishing between unwanted and innocuous defects to further improve accuracy by flagging innocuous defects as such, and directing the operator's attention to more serious defects that could cause failure, and reduce the dowtime association with an operator having to review surface conditions that are not serious, and will not cause failure.

While the McCoy and Kanzaka combination teaches the inspection of coiled tubing as it is deployed, the combination does not teach:

A composite coiled tubing having layers of fibers forming the tubing wall;

The outermost layer having a stripe; and

The processor detecting a circumferential position of a defect in reference to the stripe.

Newman teaches a system for inspecting coiled tubing (figure 1), comprising the inspection of a composite coiled tubing ("composites" at column 1, line 12) having layers of fibers forming the tubing wall (layers of fibers is an inherent characteristic of a composite). Newman states that "coiled tubing is made of plastic, composites, titanium or steel" at column 1, line 11.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to inspect, using the McCoy and Kanzaka combination, composite coiled tubing because it is one of the primary materials with which coiled tubing is made.

Furthermore, Newman teaches a longitudinal stripe on the outer surface of the tubing ("a visible line is marked along the coiled tubing" at column 3, line 42). The purpose of this stripe as described by Newman is as a reference mark, for visual monitoring via. a camera, from which to monitor tubing characteristics such as rotation ("coiled tubing can be marked and locations of markings can be measured in a variety of ways", "rotational orientation of the line … is

monitored visually, with ... camera(s)" at column 3, lines 40-45; "take discrete rotational measurements at one or at a plurality of locations on a length of coiled tubing while it is being unspooled" at column 3, line 23; the rotation of the tube is a measure of "fatigue damage" at column 4, line 25).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the tubing of the McCoy and Kanzaka combination with at least one longitudinal stripe for purposes of measuring rotational orientation and "fatigue damage" of the tubing, thereby providing another important measure of the tubing's overall condition.

Finally, while the McCoy, Kanzaka and Newman combination teaches the detection of defects on a composite coil tubing having a stripe, the combination does not teach providing a circumferential position of a defect in reference to the stripe.

Ries discloses a system for inspecting tubing ("testing of pipes" in the title; "tube, pipe, or other hollow" at column 3, line 12), comprising relating defects found during an inspection ("defects" at column 3, line 59) to a reference mark on the tubing itself ("central marking" at column 3, line 35; "the ultrasonic test equipment identified the locations of these defects, e.g. by signals representing he distance of the suspected defects from the central marking on the pipe" at column 3, line 60).

Given the art as a whole, it would have been obvious at the time the invention was made to one of ordinary skill in the art to relate any defects found in the McCoy, Kanzaka and Newman combination to the central marking, or stripe on the composite tubing, so that the defects can be easily located in the circumferential direction during later visual inspection.

(B) Response to Arguments:

At page 23, section III.P. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

18. Claim 14 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Newman (US 6,321,596 B1), Reis et al. (US 4,311,905 A) and Garcia et al. (US 5,923,771 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Newman (US 6,321,596 B1) and Reis et al. (US 4,311,905 A) combination as applied to claim 13 above, and further in combination with Garcia et al. (US 5,923,771 A).

The McCoy, Kanzaka, Newman and Reis combination, while teaching the detection of flaws on the tubing surface, the surface inherently having a color (if it didn't, it would be invisible), does not teach analyzing the tubing surface to detect the color of the tubing segment.

Garcia discloses a system for inspecting an object for flaws from an image ("determine the size of cracks and bubbles in copper bars" at column 2, line 7), comprising analyzing the object surface to detect the color of the object ("identifies the color of each square (white if it corresponds to the background and black if it corresponds to a flaw" at column 3, line 18; "color" at column 3, lie 20).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to adapt the defect detection of the McCoy, Kanzaka, Newman and Reis combination to detect the color of the tubing segment as taught by Garcia, in order to distinguish defects on the tubing that are of a different color than the background because using this method, "there is no problem with regard to the alteration or contamination of the object being measured" (Garcia, column 3, line 35), and it provides a "reliable method of rapid and precise detection which is easy to handle" (Garcia column 1, line 54).

(B) Response to Arguments:

At page 23, section III.Q. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

19. <u>Claim 36 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Newman (US 6,321,596 B1), Reis et al. (US 4,311,905 A) and Ortiz et al. (US 4,988,875 A).</u>

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Newman (US 6,321,596 B1) and Reis et al. (US 4,311,905 A) as applied to claim 13 above, and further in combination with Ortiz et al. (US 4,988,875 A).

The McCoy, Kanzaka, Newman and Reis combination does not teach the imaging of the tubing using "a plurality of imaging devices" to capture the "outer circumference of the tubing" as required by claim 36.

Ortiz discloses a system for inspecting a coiled tubing for defects (figure 11), comprising imaging the tubing using a plurality of imaging devices to capture the outer circumference of the tubing ("three ... cameras, positioned to view the cable from angles of 120 degrees from each other, can provide view of the entire bulk of the cable jacket" at column 6, line 57).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the McCoy, Kanzaka, Newman and Reis combination with a plurality of cameras as taught by Ortiz, in order to provide a "view of the entire bulk" of the cable (Ortiz, column 6, line 57) so that no defects are obscured by hidden views when only a single camera is used, thus provide a more complete inspection of the entire circumference.

(B) Response to Arguments:

At page 24, section III.R. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

20. Claims 31, 34 and 37 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), and Ortiz et al. (US 4,988,875 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 31, 34 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A) and Kanzaka et al. (US 5,680,473 A), and further in combination with Ortiz et al. (US 4,988,875 A).

Regarding claim 31, McCoy discloses an inspection system for coiled tubing employed in a well (figure 4; "as the coiled tubing is unwound from the reel" at column 6, line 60; the tubing is inspected for "dents, wall thinning, cracks", etc. at column 5, line 33), comprising:

a sensing device (figure 4, numeral 52) sensing a condition of the coiled tubing surface (figure 4, numeral 16) as the coiled tubing is being injected into or removed from a well ("as the coiled tubing is unwound from the reel" at column 6, line 60).

While McCoy contemplates any type of sensing device to achieve the desired inspection results (see "particular coiled tubing and test apparatus are neither the present invention nor limiting ..." at column 5, line 42), McCoy does not teach the remaining elements of claim 31 that are directed to image inspection. These elements are addressed in the description of the secondary teachings below.

Kanzaka discloses a system in the same field defect inspection (see figure 1), and in the same problem solving area of detecting and recording defects on a moving body (figure 1, numeral 1), comprising:

an imaging device (figure 1, numeral 2) recording video signals (figure 1, "v") of a segment of a moving body to be inspected (figure 1, numeral 1);

a flaw detection processor receiving the video signals (figure 1, numeral 3); and

a program in the processor configured to execute pattern recognition software and analyze each image separately to detect discrete anomalies on the object (figure 1, numeral 3; "An image or video signal v from the video camera 2 is processed by an inspection machine 3 that is an electronic processor to inspect the existence or not of defects such as flaws, dirty or the like on the surface of the inspected object" column 2, lines 59-62).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to employ, as the sensor and computer required by McCoy at figure 4, numerals 52 and 54, the camera and image analysis method of taught by Kanzaka (i.e., figure 1, numeral 3) in order to detect flaws on the coiled tubing of McCoy. One would be motivated to utilize the camera and image analysis method of Kanzaka for the following reasons:

In order to provide the operator with a complete set of the necessary data for the inspected object so that any defects and their locations are "readily apparent" (Kanzaka column 4, line 10), so that "an accurate judgment to the acceptance or rejection of the defect on the inspected object 1 can be made" (Kanzaka column 4, line 33A);

To provide the additional benefit of sorting "the grades of the defects" (Kanzaka column 4, line 36) which further assists on operator in separating potential defects from serious defects;

To minimize storage requirements by only storing the necessary data and images of defects ("minimum usage" at Kanzaka column 4, line 24);

To provide an increase in the "inspection speed" (Kanzaka column 1, line 39) thus allowing the tubing to be inspected at a higher speed, thereby reducing inspection time; to

Recognizing unwanted defects ("X marks ... cannot be overlooked" at column 3, line 18) and ignoring innocuous defects ("O marks ... may be ignored" at column 3, line 20) thus distinguishing between unwanted and innocuous defects to further improve accuracy by flagging innocuous defects as such, and directing the operator's attention to more serious defects that could cause failure, and thus reduce the downtime associated with an operator having to review surface conditions that are not serious, and will not cause failure.

The McCoy and Kanzaka combination does not teach the imaging of the tubing using "a plurality of imaging devices" to capture the "outer circumference of the tubing" as required by claim 31.

Ortiz discloses a system for inspecting a coiled tubing for defects (figure 11), comprising imaging the tubing using a plurality of imaging devices to capture the outer circumference of the

tubing ("three ... cameras, positioned to view the cable from angles of 120 degrees from each other, can provide view of the entire bulk of the cable jacket" at column 6, line 57).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the McCoy and Kanzaka combination with a plurality of cameras as taught by Ortiz, in order to provide a "view of the entire bulk" of the tubing (Ortiz, column 6, line 57) so that no defects are obscured by hidden views when only a single camera is used, thus ensuring complete inspection of the entire circumference.

Regarding claim 34, the limitations therein are met by the McCoy, Kanzaka and Ortiz combination described above. That is, Kanzaka teaches the transmission of a location counter (Kanzaka figure 1, numeral 1') to the processor (Kanzaka figure 1, the "I" signal traveling to numeral 3) to identify the poison along the moving body at which images are taken ("such distance data will be contained in data D" at Kanzaka column 3, line 67; data "D" is merged with the captured images as described at column 3, lines 40-43). Further, Kanzaka teaches a display of the images (figure 1, numeral 12). All these limitations are incorporated into the inspection system of McCoy per the aforementioned combination.

Regarding claim 37, the McCoy, Kanzaka and Ortiz combination teaches plural cameras (i.e., Ortiz figure 11, numerals 36) that are utilized to capture the images required by the McCoy and Kanzaka combination. Ortiz also teaches illumination sources are required by claim 37 (Ortiz figure 11, numerals 25). It would have been obvious to include the illumination sources of Ortiz in the combination in order to properly illuminate the tubing under inspection so that a well defined, high contrast image is captured to ensure defect detection accuracy. The combination does not teach transmitting power to the image devices and illumination sources. However, this

would have been obvious to one skilled in the art in order to operate the devices, given that both the light sources and cameras require power to operate (the examiner is unaware of any cameras or light sources that don't require power).

(B) Response to Arguments:

At page 24, section III.S. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

21. Claim 33 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Ortiz et al. (US 4,988,875 A) and Newman (US 6,321,596 B1).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A) and Ortiz et al. (US 4,988,875 A) as applied to claim 31, and further in combination with Newman (US 6,321,596 B1).

While the McCoy, Kanzaka and Ortiz combination teaches the image inspection of coiled tubing as it is being deployed (i.e., figure 4, numeral 52), comprising a guide roller mechanism and a storage reel (both seen in McCoy figure 1), the combination does not teach the placement of the cameras, and hence the apertures in close proximity to the guide rollers as required by claim 33.

Newman discloses a system for inspecting coiled tubing as it is being deployed, comprising the placement of sensors, including cameras (figure 3, numeral 100), in close proximity to the guide rollers (figure 1, numeral 203).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to place the cameras of the McCoy, Kanzaka and Ortiz combination in close proximity to the guide rollers as taught by Newman, in order to place them in an area between the spool and the guide rollers where an unobstructed image of the entire circumference of the tubing can be obtained as the tubing is spooled off the reel, thereby ensuring a complete coverage of the inspected area.

(B) Response to Arguments:

At pages 24-25, section III.T. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

22. Claim 42 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Ortiz et al. (US 4,988,875 A) and Husseiny (US 5,210,704 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 42 is unpatentable over the combination of the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A) and Ortiz et al. (US 4,988,875 A) as applied to claim 31, and further in combination with Husseiny (US 5,210,704 A).

While the McCoy, Kanzaka and Ortiz combination processes images to detect defects, the combination does not teach determining if the size of previously recognized anomaly has grown beyond a user-designated percentage of its original size.

Husseiny discloses a system in the field of defect inspection and failure analysis, comprising identifying an anomaly as a defect by determining if a size has grown beyond a percentage of its original size (figure 17).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to monitor defect growth on the coiled tubing of the McCoy, Kanzaka and Ortiz combination, and thereby identifying defects when a threshold has been reached as taught by Husseiny, in order to identify "incipient failures ... during operation" and provide an indication to the operation of the tube's "expected life" along with "a warning for the remaining time until

failure of the equipment" (Husseiny, column 4, lines 40-54), thereby providing the operator with the ability to predict a failure before it actually occurs in order to take appropriate action and avoid costly losses during an operation.

(B) Response to Arguments:

At page 25, section III.U. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

23. Claim 35 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Ortiz et al. (US 4,988,875 A) and Vild et al. (US 4,123,708 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 35 is unpatentable over the combination of the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A) and Ortiz et al. (US 4,988,875 A) as applied to claim 34, and further in combination with Vild et al. (US 4,123,708 A).

Regarding claim 35, the McCoy, Kanzaka and Ortiz combination does not teach markings indicating the position of the discrete anomalies in the tubing.

Vild discloses a system for inspecting tubes for flaws ("flaw inspection" and "pipe" at column 3, lines 35 and 37), comprising markings on the coiled tubing to provide location data on the coiled tubing ("marking of the location of the defect" at column 5, line 50; "marking gun" at column 6, line 5).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the McCoy, Kanzaka and Ortiz combination to provide markings on the tubing where discrete anomalies are detected as taught by Vild, thereby providing a visual "indication not only of the longitudinal location of the defect, but also an indication of the circumferential location of the defect" (Vild column 5, line 53). These markings provide the combination with an easy, intuitive way from which to subsequently locate the defects both in the images and on the actual pipe.

(B) Response to Arguments:

At page 25, section III.V. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

24. Claim 38 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Ortiz et al. (US 4,988,875 A) and McCafferty et al. (US 6,273,188 B1).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A) and Ortiz et al. (US 4,988,875 A) as applied to claim 31, and further in combination with McCafferty et al. (US 6,273,188 B1).

The McCoy, Kanzaka and Ortiz combination does not teach camera location, and therefore does not teach placing the camera system on a levelwind that is coupled to a reel of the tubing. However, McCoy teaches the taking of measurements of the tubing as it is spooled from a reel onto a roller track (McCoy figures 1-3), and McCoy teaches sensor placement in an area where the tubing can be inspected as it passes the sensor (figure 4, numeral 52).

McCafferty teaches the spooling of coiled tubing from a reel onto a roller track (figure 1), comprising a levelwind (figure 1, numeral 26) coupled to a reel of the tubing (as depicted in figure 1).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to attach the camera system of the McCoy, Kanzaka and Ortiz combination to a levelwind

coupled to a reel of the tubing as taught by McCafferty, thereby providing a stable platform for the camera system to clearly capture images of the tubing as it is being spooled or unspoiled from the reel.

(B) Response to Arguments:

At page 26, section III.W. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

25. Claims 39 and 40 - Obvious in view of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A), Ortiz et al. (US 4,988,875 A) and Morrison et al. (US 5,033,096 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 39 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McCoy et al. (US 5,767,671 A), Kanzaka et al. (US 5,680,473 A) and Ortiz et al.

(US 4,988,875 A) as applied to claim 31, and further in combination with Morrison et al. (US 5,033,096 A).

Regarding claim 39, the McCoy, Kanzaka and Ortiz combination captures video images and transmits them to a defect detection processor (Kanzaka figure 1, numerals 2-3). The combination does not teach storing the images on a recordable media prior to processing the images.

Morrison teaches a system for visually inspecting a moving article (figure 1), comprising capturing video images (figure 1, numeral 6) and storing the images on a recordable media (figure 1, numeral 9, "framestore") prior to processing (figure 1, numeral 10). That is, Morrison teaches an image grabber input device (figure 1, numeral 9) receiving the video signals (figure 1, numeral 8) and generating sequential images of the moving object's surface from the video ("captured signals corresponding to each frame of video signals are preferably digitized ..." at column 4, line 38).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to store the video images of the McCoy, Kanzaka and Ortiz combination (i.e., the "v" signal indicated at Kanzaka figure 1) prior to processing the images (i.e., Kanzaka figure 1, numeral 3) as taught by Morrison. One would be motivated to incorporate the digitizer/framestore of Morrison into the above combination for the following reasons:

To provide a storage device for the images to ensure that none were lost or corrupted in the event of a power failure or glitch;

To process individual images as is required by the McCoy, Kanzaka and Ortiz combination (i.e., "an image ... is processed" at Kanzaka column 2, line 59) by converting the

input video signal, which is a continuous signal representing a plurality of images in serial sequence, into individual digitized images;

Because of the ability to "collect the video information sufficiently quickly that the spatial resolution of the camera is not degraded, and to digitized the information into a large range of numbers representing brightness or gray levels" (Morrison, column 7, line 10), thus producing an accurate image in a short period of time; and

Because of the ability to store the images "in a dedicated area of memory" (Morrison, column 7, line 27) which offers "higher overall system speed" (Morrison, column 7, line 34), thus providing the McCoy and Kanzaka combination with the ability to accurately process more images to ensure that no defects on the moving tubing are missed.

Regarding claim 40, given that Kanzaka, as part of the McCoy, Kanzaka and Ortiz combination described above, teaches a position counter (i.e., Kanzaka figure 1, numeral 1') whereby the counter value is transmitted to the processor 3 for storage with the images, it would have been obvious to include and store those values with the images for the same reasons and motivation provided in the claim 39 rejection above (i.e., so they are not lost or corrupted in the event of a power failure, etc.).

(B) Response to Arguments:

At page 26, section III.X. of the arguments, applicant refers to his previous remarks which have been addressed by the examiner above.

26. Claim 13 - Obvious in view of Lam (US 5,043,663 A), Kanzaka et al. (US 5,680,473 A) and Newman (US 6,321,596 B1).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination Lam (US 5,043,663 A) and Kanzaka et al. (US 5,680,473 A), and further in combination with Newman (US 6,321,596 B1).

Regarding claim 13, Lam discloses:

a tubing ("pipe associated with oil and gas wells" at column 4, line 8), the outermost layer having a longitudinal stripe ("longitudinal seam" at column 6, line 64);

an inspection device taking readings of a segment of the coiled tubing ("inspection head 12" at column 5, line 28) as the coiled tubing is presented before the imaging device ("inspected during removal from the well" at column 4, line 12).

a processor receiving the inspection signals from the inspection head (figures 1 and 2, numeral 18); and

a program in the processor ("computer program" at column 10, line 52) analyzing the inspection signals to detect a circumferential position of a defect in reference to the stripe (figure 4A; the defects are represented at numerals 50, in relation to their longitudinal and

circumferential positions with respect to each other; pipes having the aforementioned seam, while not necessarily depicted in figure 4A, would also appear here as plotted data is clear from column 6, lines 65-68; thus, defects are plotted in relation to the seam).

Lam inspects tubing for such defects as "inclusions", "gouges", (both at column 1, lines 20-21), "mechanical damage, pitting and fatigue cracks" (column 1, line 40). While Lam indicates that any type of inspection device "capable of generating a suitable defect signal" (column 5, line 38) can be used in the context of the invention, and while Lam suggests "visual inspection" (column 6, line 52), Lam does not teach:

An imaging device recording video signals of the coiled tubing, where the processor receives the **video signals from the imaging device**; and

Where the program in the processor analyzes the inspection signals **video signals to detect the defects.**

Kanzaka discloses a system in the same field of optical defect inspection (see figure 1), and in the same problem solving area of detecting and recording defects on a moving body (figure 1, numeral 1), comprising computer analysis of individual images in order to determine the presence of a defect (figure 1, numeral 3; "An image or video signal v from the video camera 2 is processed by an inspection machine 3 that is an electronic processor to inspect the existence or not of defects such as flaws, dirty or the like on the surface of the inspected object" column 2, lines 59-62).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to employ, as the inspection method required by Lam, the computer image analysis

processor taught by Kanzaka (i.e., figure 1, numeral 3). One would be motivated to utilize the processor of Kanzaka for the following reasons:

- Computer processors are faster than discrete analog circuitry, and the algorithms can be modified, updated or changed without major hardware adjustments;
- In order to provide the operator with a complete set of the necessary data for the inspected object so that any defects and their locations are "readily apparent" (Kanzaka column 4, line 10), so that "an accurate judgment to the acceptance or rejection of the defect on the inspected object 1 can be made" (Kanzaka column 4, line 33A);
- To provide the additional benefit of sorting "the grades of the defects" (Kanzaka column 4, line 36) which further assists on operator in separating potential defects from serious defects;
- To minimize storage requirements by only storing the necessary data and images of defects ("minimum usage" at Kanzaka column 4, line 24);
- To provide an increase in the "inspection speed" (Kanzaka column 1, line 39) thus allowing the tubing to be inspected at a higher speed, thereby reducing inspection time; to
- Recognizing unwanted defects ("X marks … cannot be overlooked" at column 3, line 18) and ignoring innocuous defects ("O marks … may be ignored" at column 3, line 20) thus distinguishing between unwanted and innocuous defects to further improve accuracy by flagging innocuous defects as such, and directing the operator's attention to more serious defects that could cause failure, and reduce the downtime association with an operator having to review surface conditions that are not serious, and will not cause failure.

The Lam and Kanzaka combination does not teach the tubing as having layers of fibers.

Newman also teaches a system for inspecting a coiled tubing (figure 3), comprising the inspection of a composite tubing ("coiled tubing" and "composites" at column 1, lines 8 and 11) having layers of fibers ("composite" pipes have layers of fibers), the outermost layer having a longitudinal stripe ("visible line" at column 3, line 42).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to inspect composite tubing, such as the tubing taught by Newman, using the system of the Lam and Kanzaka combination, because the oil and gas well tubing that Lam seeks to inspect includes not only metal tubing as taught by Lam, but also plastic and composite tubes as taught by Newman (column 1, line 11). One would be motivated to inspect composite tubing because it is commonly used in the industry, and also requires the same types of inspection for flaws and imperfections and the Lam and Kanzaka is ideally suited to do so, because it uses image analysis and can distinguish the stripe of the Newman tubing from the other defects using the defect plot of Lam at figure 4A.

(B) Response to Arguments:

Applicant's arguments at pages 26-28 of the arguments and relating to the Kanzaka reference have been addressed by the examiner above. It is noted that the applicant has argued

that "Ortiz" does not meet certain limitations of claim, however Ortiz is not part of the rejection. It is also noted that the applicant does not address the Lam or Newman references in his response.

27. Claim 36 - Obvious in view of Lam (US 5,043,663 A), Kanzaka et al. (US 5,680,473 A), Newman (US 6,321,596 B1) and Ortiz et al. (US 4,988,875 A).

(A) Rejection:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination Lam (US 5,043,663 A), Kanzaka et al. (US 5,680,473 A) and Newman (US 6,321,596 B1) as applied to claim 13, and further in combination with Ortiz et al. (US 4,988,875 A).

The Lam, Kanzaka and Newman combination does not teach the imaging of the tubing using "a plurality of imaging devices" to capture the "outer circumference of the tubing" as required by claim 36.

Ortiz discloses a system for inspecting a coiled tubing for defects (figure 11), comprising imaging the tubing using a plurality of imaging devices to capture the outer circumference of the tubing ("three … cameras, positioned to view the cable from angles of 120 degrees from each other, can provide view of the entire bulk of the cable jacket" at column 6, line 57).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the Lam, Kanzaka and Newman combination with a plurality of cameras as taught by Ortiz, in order to provide a "view of the entire bulk" of the cable (Ortiz, column 6, line 57) so that no defects are obscured by hidden views when only a single camera is used, thus provide a more complete inspection of the entire circumference.

(B) Response to Arguments:

Applicant's Argument: Motivation for the combination is lacking, and all of the elements are not taught (page 28, section III.Z. of the response).

Examiner's Response: Motivation was and is provided for the combination – see the rejection. Applicant has not pointed out which elements are lacking from the combination.

Conclusion

28. This is a continuing prosecution of applicant's earlier Application No. 10/032,272. All claims are drawn to the same invention claimed in the earlier application and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the earlier application. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action in this case. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

29. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian P. Werner whose telephone number is 571-272-7401. The examiner can normally be reached on M-F, 8:00 - 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Mancuso can be reached on 571-272-7695. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Brian Werner
Primary Examiner
Art Unit 2621
September 26, 2005

BRIAN WERNER
PRIMARY EXAMINER